DOCUMENT RESUME

ED 271 446 SP 027 770

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TITLE The Academy in Mentoring: A Model for Encouraging the Academic Achievement of Young Adolescent Girls.
SPONS AGENCY Women's Educational Equity Act Program (ED), Washington, DC.
PUB DATE Feb 86
NOTE 18p.; Paper presented at the Annual Meeting of the Association of Teacher Educators (Atlanta, GA, February 22-26, 1986).
PUB TYPE Reports - Descriptive (141) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Academic Achievement; *Adolescent Development; *Females; Junior High Schools; *Mentors; Student Attitudes; Teacher Influence; *Teacher Student Relationship; *Womens Education

ABSTRACT

The purpose of the Academy in Mentoring (Project: AIM) was to increase the number of junior high girls with academic potential to elect mathematics, science, and technical courses throughout high school and/or college, in order to provide them with greater future career opportunities. Teachers and counselors from three selected junior high schools were assisted in the development of a mentoring academy for academically able girls. The 15 teachers and 30 girls were involved in a series of training activities throughout the yearlong project. Affective and cognitive changes among teacher/mentors and students were measured by three pre- and post-test survey instruments. Significant differences on several variables were found in knowledge and attitudes of the Mentoring Academy population when compared to the control groups. Project: AIM had a positive impact on the knowledge of how mathematics and science courses provide access to many career opportunities. Both teachers and students gained an awareness of the factors which limit female representation in advanced mathematics, science, and technology courses. The results of this project support the premise that teachers can develop mentoring skills, adopt attitudes supportive of the need to encourage girls to excel in mathematics, science, and technology, and influence girls' career aspirations. (Author)

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THE ACADEMY IN MENTORING:
A MODEL FOR ENCOURAGING THE ACADEMIC ACHIEVEMENT OF YOUNG ADOLESCENT GIRLS

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SP 027 770

Paper presented at the Annual Meeting of the Association of Teacher Educators
February, 1986
Atlanta, Georgia

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The model was developed and tested under a grant from the U.S. Department of Education, Women's Educational Equity Act Program. Opinions expressed do not necessarily reflect the position or policy of the Department, and no official endorsement should be inferrred.

Abstract

The purpose of the Academy in Mentoring (Project: AIM) was to increase the number of junior high girls, with academic potential, to elect math, science and technical courses throughout high school and/or college in order to provide them with greater future career opportunities. Teachers and counselors from three selected junior high schools were assisted in the development of a mentoring academy for academically able girls.

The fifteen (15) teachers and thirty (30) girls were involved in a series of training activities throughout the year-long project. Affective and cognitive changes among teacher/mentors and students were measured by three pre-post test survey instruments. Significant differences on several variables were found in knowledge and attitudes of the Mentoring Academy population when compared to the control groups. Project: AIM had a positive impact on the knowledge of how math and science courses provide access to many career opportunities. Both teachers and students gained an awareness of the factors which limit female representation in advanced math, science and technology courses.

The results of this project support the premise that teachers can develop mentoring skills, adopt attitudes supportive of the need to encourage girls to excel in math, science and technology, and influence girls' career aspirations.

THE ACADEMY IN MENTORING: A MODEL FOR ENCOURAGING THE ACADEMIC ACHIEVEMENT OF YOUNG ADOLESCENT GIRLS

INTRODUCTION

The need to develop creative ways to achieve educational and occupational equity is critical in scientific and technological fields. Research shows women are underrepresented in these career areas. Persistent beliefs that girls can not or do not need to excel in math, science and technology continue to limit the development of academic potential and motivation to achieve among girls and women.

In order to address these needs, a novel project was conceptualized to impact two important groups: teachers and their students. After funding was obtained, collaboration occurred among four educational institutions and a major corporation. Four university faculty women from a regional state supported university formed an interdisciplinary team to provide the leadership needed to work with selected teachers and students from three diverse junior high schools in southeastern Michigan.

The project which resulted, The Academy in Mentoring (Project: AIM), is a model organized to intervene early in the lives of adolescent girls before attitudes are set which limit academic goals. This model project was designed to encourage girls with academic potential to take math, science and technological courses. Teachers were provided training and given opportunity to practice mentoring skills. Girls were encouraged by their teacher/mentors to consider a wide range of career options available to persons with scientific and technological knowledge and skills.

This paper will describe the model project (Project: AIM) which used teachers as mentors of junior high school girls, the findings related to changes in attitude and knowledge of the proteges, and recommendations for teacher education programs.

PURPOSE AND PROJECT DESIGN

The overall purpose of the Mentoring Academy Project was to encourage young women with academic potential to take math, science and technical courses throughout high school and college in order to provide them with greater career opportunities. To accomplish this, the teachers were trained in the mentoring process and the girls given information about careers which use math, science and technology. Opportunities were provided for both groups to become aware of the factors which limit the participation of women in the sciences and technology.

Project:AIM was distinctive in several ways. Mentoring of students at the junior high level was seen as a critical need and the focus was on both students and their teachers. Collaboration occurred among university faculty, public school teachers and a major corporation. An advisory committee was organized to assist with Project: AIM. This group was comprised of representatives from business and industry, university faculty, the intermediate school district and the State Department of Education.

Many intervention-type projects exist for both high school and college age women (Place, 1980, Menard, 1980, Koltnow, 1980). Few programs address the needs of girls, ages 12-15, or the use of their teachers as mentors. This age group is at a vulnerable point where intervention is critical (Erb, 1981). Thus, Project: AIM was designed to include a series of teacher training sessions, on-campus events, and individual building level activities for teachers and students at the junior high school level.

Other researchers (Fish, 1979, Hennecke, 1983, Johnson, 1980, Place, 1980, Stewart and Taylor, 1978) have described the effects of the mentoring process in developing talent. Therefore, a mentoring process provided the framework for this project. Teachers were provided mentor training and assisted with the organization of building mentoring academies.

The three project sites were selected because of the diversity of the populations which they serve. One school was primarily urban and minority, one mainly rural, and one urban/suburban with all representing mixed income levels. Students and their mentors participated in career enrichment and educational activities during the bi-monthly building level academy meetings. One university project staff member served as coordinator of each building academy. Teacher/mentors often met informally during the school day with students to provide support.

Objectives were written to assist teachers to recognize academically talented girls, to develop the skills and strategies needed for mentoring junior high age girls in the selection of career goals, and to increase the sensitivity of teachers to inhibitors which limit the career aspirations of girls.

Mentoring Academy activities were also designed to meet objectives related to the girls. Through these activities, the girls became aware of the application of scientific, mathematical and technological skills to daily living and occupational areas, acquired positive attitudes and self-confidence in their abilities, and shared a support network.

PROCEDURE

Teacher Selection

Initial contact was made with principals in each of the selected schools. The principals assisted with the teacher selection process by presenting the project concept to all teachers and counselors, offering them the opportunity to volunteer to participate in the Academy in Mentoring. Project: AIM staff then met with interested teachers to further explain the program. In instances where more teachers than the five needed in each building volunteered, project staff made the final selection based on their perceptions of the candidate's interest, commitment, and contact with students. In one school, final selection was determined by the principal.

Six males and nine females participated as teacher/mentors. While various age levels were represented, nearly one-half of the teacher/mentors were in their 30's. Five math teachers, but no science teachers, volunteered.

Student Selection

The selection process for the thirty girls began with the principal or a counselor at each site compiling a list of high achieving seventh and eighth grade girls identified through achievement test scores or from the school honor role. The Career Attitude Survey questionnaire was administered to all seventh and eighth grade students at each of the three sites in an effort to ascertain students who held low or unclear career aspirations. A student participation pool was then developed using high potential and low career aspiration as the criteria. The teacher/mentors at each school site reviewed the lists collectively and, using their own

knowledge about the girl(s), made recommendations about which ones to select for the project. Finally, parents of those chosen were contacted. At the project orientation meeting, parents were asked for written permmission for their daughter to participate in the program.

As part of the evaluation procedure girls identified as potential Academy participants, but not selected, were asked to respond to the Project: AIM Knowledge and Attitude Scale for Students (KASS). This instrument was administered prior to and at the completion of the project thus serving as the student control group. These data were compared with responses obtained from the experimental group.

Intervention Strategies

Activities were designed to meet previously described project objectives. The first campus workshop held for teacher/mentors helped to increase awareness of teacher attitudes and behaviors which inhibit girls' potential. Selected strands from the TESA model (Teacher Expectations and Student Achievement) were included as part of the program. Researchers from the University of Michigan reported on the influence of gender, and parent and teacher attitudes on math achievement.

During this first session, teachers were asked to identify mentoring skills and behaviors based on personal knowledge and experience. From this, the "How to Mentor" guide was compiled and distributed to all teacher/mentors for use in working with students in the Mentoring Academy.

Workshops held in April, September, October and December included all members of the three mentoring academies (30 students, 15 teachers and 4 project staff). The focus of the first workshop in April was on personal motivation and goal-setting. An informal follow-up session occurred at a

picnic/outing early in September.

The October workshop theme was "Adventures in Science". After lunch at the sponsoring university, the Academy members attended four workshops presented by Science, Mathematics, and Technology professors. Computers, robotics, biological experiments and chemistry magic gave both the students and their teachers hands on experience as well as stimulated thinking about career opportunities using math, science and technical knowledge.

In December, members of the three mentoring academies were guests of the Ford Motor Company Design Center. Eight women engineers and managers spoke to the group about their career decisions, educational backgrounds and work experience. A tour of the Design Studio, where futuristic models are created, was the highlight of the afternoon.

In the schools, building level Academy groups met regularly. These meetings provided teacher/mentors with the time to practice mentoring skills. Students received information which related to careers based on math and science knowledge. Varied activites included viewing video tapes ("Nothing But Options" and "Women in Science"), completing paper and pencil games (e.g. "Odds on You"), touring a district vocational school, "shadowing" local professional women in preferred career areas, and discussing high school course offerings with appropriate counselors.

A university project staff member served as the facilitator for each building Mentoring Academy. Facilitators modeled mentoring skills and provided educational enrichment materials to be used at the Academy meetings. Project staff also distributed appropriate materials related to the mentoring process.

Evaluation

The evaluation was organized to examine the design of the Project: AIM model and the overall effectiveness of the project. Questions used to guide the evaluation component were: 1) How well was the program implemented? 2) Did the teacher/mentors feel they gained new knowledge and skills as a result of the program? 3) Were there differences between the students and controls in attitudes, perceptions, and knowledge? 4) What are the outcomes of Project: AIM?

The sources of data used to answer the evaluation questions included both quantitative (questionnaires for both teacher/mentors and students) and qualitative (observations, staff meeting records, and journals) measures.

Three survey instruments were developed specifically for and used in this project. The Career Attitude Survey was distributed to all students in grades seven and eight in the three junior high schools. Basic demographic data (including family background and education) were obtained. Students identified occupational and educational goals plus the number and types of math, science and technology courses they had previously taken or planned to take in the future.

The KASS (Knowledge and Attitude Survey-Students), used with the participants and controls, was designed to measure attitudes and knowledge of subjects. Pre-test data were collected prior to any intervention. Post-tests were administered ten months later. Pre and post test data were collected from the fifteen teacher/mentors and a teacher control group through the use of KAST (Knowledge and Attitude Survey-Teachers).

For the quantitative analysis, Statistical Package for the Social Sciences was used and the five percent probability was chosen as the

significant level. Descriptive differences between subjects are summarized. Differences between subjects and controls were determined and both the direction and magnitude of the differences indicated. Qualitative measures are integrated into the discussion in order to provide a richer interpretation of the quantitative data. The qualitative data also helps to explain project process and results.

The evaluation procedures were designed for the purpose of accountability. It was necessary to measure if project objectives had been accomplished rather than to test the amount of change produced by the interventions. Therefore, no attempt to control intervening variables was made.

FINDINGS & DISCUSSION

This section reports the findings about how and to what extent project objectives were met.

By the end of the project, students stated that they "strongly agreed" that they had a couple of friends who encouraged them to do well in school (see Table 2, Variable 9). While the "friends" may or may not have been Academy members it is worth noting that the subjects apparently choose friends who will support their academic achievement. In addition, observations by the project staff site facilitators suggest that group comraderie did occur and was beginning to consolidate into a potential support network as the girls shared common experiences within the Academy sponsored activities. Indices observed included the girls reminding one another of upcoming Academy activities, conferring with one another on future course selections, and walking and talking together between classes.

The subjects stated that their knowledge of the different kinds of jobs that use math, science and technology was "very good" while the controls responded that their knowledge was only "fair", by the end of the project (see Table 2, Variables 3,5,7). In addition, subjects reported more knowledge about how to use science in their everyday lives. All of the Academy activities involving the students focused on the importance of math, science and technology and the occupations which use these skills. It appears that in all cases, subjects have more knowledge than their peers. It is reasonable to assume that this effect was in part due to the participation of the subjects in Project: AIM.

Differences in attitudes and self-confidence between controls and subjects show up in questions related to women in non-traditional roles. While both subjects and controls disagree about sex role stereotyping in occupations, the level of dissent is significantly stronger for the subjects (see Table 2, Variable 12). Subjects demonstrated heightened awareness of the reality of women in the workplace (see Table 2, Variables 16,17,19).

The findings clearly indicate that differences do exist between girls who participated in Project: AIM and those who did not. However, when pre and post test data for each subject were analyzed, there was no significant changes noted - the subjects started out with a high perception of knowledge and confidence and their high level was sustained throughout the duration of the project. Subtle changes were noted and recorded by project staff. For example, one girl who indicated on the Career Attitude Survey (CAS) pre-test that becoming a nurse was an occupational choice, listed doctor as a career choice on the post-test. Another girl who was uncertain of a career on the pre-test wrote that she wanted to be an engineer. An

unsolicited comment from the mother of one girl:

> I know my daughter is capable and I've always tried to encourage her to reach beyond the traditional women's occupations but it wasn't until her sights were expanded through this project that she considered being a scientist instead of a secretary, a doctor instead of a nurse.

captures the impact of Project: AIM on individual girls.

When data were compared to determine the differences between the three participating schools, no significant differences were found for any of the variables studied.

Thus it is reasonable to conclude that Project: AIM did achieve its objectives irrespective of locality, socio-economics or ethnic differences in the participants.

CONCLUSIONS AND IMPLICATIONS

This model project demonstrated that attitudes can be changed given ongoing activities which provide opportunities to gain new knowledge and exchange ideas. The data support the conclusion that Project: AIM had a positive impact on the knowledge of both the mentors and protegees with respect to how courses in math and science in high school pave the way for access into non-traditional careers for women. Both groups also gained an awareness of the developmental inhibitors which limit representation of girls in high math, science and technology courses.

A second conclusion resulting from this demonstration project is that it doesn't take much effort to change teacher perceptions. The focus of many Academy activities was on the girls, how to increase awareness of the career opportunities available to individuals with the appropriate educational background; and to remove a critical barrier to success - the lack of self-confidence.

The teachers were quick to pick up on the focus of these activities and apply the knowledge to their interactions with all students. Comments from teacher journals revealed teacher/mentors concluded that female under-representation in science, math and technology can be primarily a function of the expectations of significant others - parents, teachers, role models. The teacher/mentors demonstrated a sense of commitment to set high expectations of success for all students.

Finally, the project results indicate the affective component to be as important as the cognitive aspects of the curriculum. Teacher/mentors consistently expressed the need to take a personal interest in their students, to be sensitive to their needs and to recognize opportunities to provide words of encouragement. They observed the impact of Project: AIM on the participating girls to include increased enthusiasm and motivation to excel in many aspects of life as well as to achieve in school subjects.

It would be useful to examine teacher preparation curricula to assure that the affective domain is addressed as systematically as content and methods. Teacher preparation courses also need to develop appropriate attitudes and behaviors which assist access to the scientific/technological career areas regardless of gender.

The results of this project support the premise that girls can be influenced by teachers and intervention strategies which encourage excellance in math, science, and technology. Teachers can influence the career aspirations of young adolescent girls.

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TABLE 1

t-TESTS FOR MEAN WEIGHT GIVEN TO VARIABLES ON KASS FOR STUDENTS, PRE-TEST

Variable #	Group	N	Mean Weight	S.D.	t-Value	df	Significance
10	Subjects	27	5.74*	0.11	3.40	44	.001
	Controls	19	5.05	0.18			
13	Subjects	27	5.85*	0.36	2.23	44	.031
	Controls	19	5.47	0.77			

Variable 10: I enjoy doing well in school.

Variable 13: I feel proud when I get good grades in school.

* (1) Very Strongly Disagree
(2) Strongly Disagree
(3) Somewhat Disagree
(4) Somewhat Agree
(5) Strongly Agree
(6) Very Strongly Agree

TABLE 2

t-TEST FOR MEAN WEIGHT GIVEN TO VARIABLES ON KASS FOR STUDENTS, POST-TEST

Variable#	Group	N	Mean Wgt.	S.D.	t-Value	df	Significance
2	Subjects	22	4.68*	0.99	4.07	39	0.00
	Controls	19	3.05	1.55			
3	Subjects	22	4.95*	1.11	3.78	39	0.001
	Controls	19	3.42	1.47			
5	Subjects	22	5.00*	1.02	3.63	39	0.001
	Controls	19	3.36	1.80			
7	Subjects	22	4.63*	1.43	3.40	39	0.002
	Controls	19	3.26	1.10			
9	Subjects	22	4.86**	1.08	2.17	39	0.04
	Controls	19	4.05	1.31			
10	Subjects	22	5.59**	0.59	2.22	39	0.03
	Controls	19	5.10	0.81			
12	Subjects	22	2.13**	1.61	-2.27	39	0.03
	Controls	19	3.42	2.01			
13	Subjects	22	5.86**	0.35	3.77	39	0.001
	Controls	19	4.10	2.16			
16	Subjects	22	1.22**	1.07	-3.23	39	0.003
	Controls	19	2.78	1.96			
17	Subjects	22	1.00**	0.00	-4.64	39	0.00
	Controls	19	3.00	2.03			
19	Subjects	22	5.50**	0.86	4.28	39	0.00
	Controls	19	3.58	1.90			

Variable 2: I would say that my knowledge of how I can use science in my everyday life is:

Variable 3: I would say that my knowledge of the different kinds of jobs that use science is:

Variable 5: I would say that my knowledge of the different kinds of jobs that use math is:

Variable 7: I would say that my knowledge of the different kinds of jobs that use technology is:

Variable 9: I have a couple of friends who encourage me to do well in school.

Variable 10: I enjoy doing well in school.

Variable 12: If I had a choice, I'd rather be a secretary than a computer programmer.

Variable 13: I feel proud when I get good grades in school.

Variable 16: I think that it is more important for boys to think about careers than for girls.

Variable 17: A woman should turn down a job if it pays a salary higher than her husband's.

Variable 19: I will probably have a job outside of my home most of my life.

* (1) Very Poor
(2) Poor
(3) Fair
(4) Good
(5) Very Good
(6) Exceptional

** (1) Very Strongly Disagree
(2) Strongly Disagree
(3) Somewhat Disagree
(4) Somewhat Agree
(5) Strongly Agree
(6) Very Strongly Agree